BRIEF COMMUNICATIONS

PARTIAL LEFT VENTRICULECTOMY FOR DILATED CARDIOMYOPATHY IN A NEWBORN

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A 3.3-kg newborn boy presented with congestive heart failure and cyanosis 3 hours after birth. Two-dimensional echocardiography (Fig 1, A) showed marked dilatation of the entire left ventricle (LV) with severe global hypokinesis. Little antegrade blood flow could be seen crossing an anatomically normal aortic valve, and Doppler interrogation of the transverse aorta confirmed ductus-dependent systemic circulation with retrograde perfusion of the aortic arch (Fig 2). In addition, the infant had severe mitral insufficiency with restricted motion of the posterior mitral valve leaflet. Coronary artery anatomy was normal. The patient was supported with intravenous dobutamine, prostaglandin, and assisted ventilation, and he was taken to the operating room on day 3 after his birth.

Cardiopulmonary bypass support was maintained with the use of bicaval cannulation, LV venting, and moderate hypothermia at 28°C. The ductus arteriosus was ligated immediately after the start of cardiopulmonary bypass. The heart was arrested with antegrade cold blood cardioplegic solution. A 2.3-cm × 4.0-cm section of the LV free wall, extending from the apex to the mitral annulus between the papillary muscles, was resected. To bring the papillary muscles nearer to the mitral annulus and improve mitral regurgitation, we placed a monofilament nonabsorbable purse-string stitch around the edge of the ventriculotomy, including the mitral annulus. This purse-string suture was tightened to bring the base of the papillary muscles closer to the mitral annulus. A linear closure, aligned along the long axis of the LV, was then performed on the now reduced ventriculotomy with reinforcing Teflon strips. The patient was weaned from cardiopulmonary bypass on high-level inotropic support. Initial hemodynamics were marginal with a mean blood pressure of 50 mm Hg, elevated left atrial pressure of 20 mm Hg, and mixed venous saturation measured from the pulmonary artery of 55% to 60%. Modified ultrafiltration was performed and the sternum remained open.

The patient's postoperative course was slow but uneventful. Delayed sternal closure was performed without difficulty on

Fig 1. End-systolic echocardiographic images from an apical 4-chamber view before (A) and 7 months after (B) partial left ventriculectomy in an infant with dilated cardiomyopathy. In A, marked left ventricular (LV) chamber dilatation can be appreciated. Evidence of left atrial (LA) hypertension also exists with bowing of an atrial septal aneurysm well into the right atrium (arrow). In B, LV dimensions are dramatically decreased compared with dimensions in the preoperative study with apparent remodeling to a more elliptic chamber contour. The left atrium remains mildly dilated.

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postoperative day 5. Over the course of several days he was weaned from the vasoactive medications and ventilatory support. He was placed on a regimen of oral digoxin, furosemide (Lasix), and captopril. A percutaneous gastrostomy tube was placed for nutrition. He was discharged from the hospital on day 36 after birth, 33 days after the operation. Examination of

Fig 2. Pulsed Doppler tracing of blood flow velocities in the transverse aorta from the preoperative echocardiogram. The systolic flow signals above the baseline represent retrograde aortic perfusion from a patent ductus arteriosus, consistent with ductus-dependent systemic circulation. No antegrade flow signals from the LV to the aorta were identified.

the resected myocardium did not identify a specific cause of the cardiomyopathy. Over the 7 months since discharge, he has demonstrated normal growth and development, as well as progressive improvement in LV function. Echocardiography at 8 months of age (Fig 1, B) showed good LV function with an ejection fraction of 50% to 60% and mild mitral regurgitation without mitral stenosis. There has been a significant change in LV dimensions compared with those shown on the initial echocardiogram, with a decrease in indexed end-diastolic diameter from 19 to 8.8 cm/m² and a decrease in indexed end-diastolic volume from 100 to 53 cm³/m² (normal 38.5 $\pm$ 5 cm³/m² in infancy).¹

Discussion. In this neonate with congenitally dilated cardiomyopathy, systemic output was initially maintained via the ductus arteriosus with retrograde flow in the aortic arch, indicating essentially no contribution of the LV to the systemic circulation. Options for this infant included partial left ventriculectomy, Norwood palliation, or cardiac transplantation. Given the long waiting time for infant heart donors and the poor condition of this neonate, we believed he would not survive long enough to obtain a graft. It was also our belief that despite the ductus-dependent systemic circulation, an attempt at a "two-ventricle" repair was preferable, with Norwood palliation as a back-up should the former approach fail. The successful application of partial left ventriculectomy to this patient, who had essentially no antegrade flow across the aortic valve before the operation, is supportive of the concept put forth by Batista and colleagues.²

The rationale for partial left ventriculectomy is to reduce LV cavity dimension (and therefore wall stress) to improve myocardial efficiency. Experience in adults demonstrates long-term improvement in LV function in some patients as a result of this LV remodeling.³ Since myocyte mitotic activity is thought to persist for 3 to 6 months after birth, there exists

the potential for myocyte division, growth, and extensive cardiac remodeling in the neonate. The patient we described has been followed up through infancy with progressively improving LV function and resolution of cardiac symptoms. Recent echocardiography demonstrates near normalization of LV ejection fraction and dramatic reduction in LV dimensions.

Mitral valve repair is performed along with partial left ventriculectomy in adult patients. We were reluctant to perform an annuloplasty on a newborn infant because of concern about distortion with growth. Our patient had mitral regurgitation due to restricted leaflet motion as a result of LV dilatation. The mitral regurgitation was managed by placing a purse-string suture around the margin of the ventriculectomy and into the mitral anulus. With tightening of the purse-string suture, the apex of the heart and papillary muscles were moved toward the anulus of the mitral valve. Restricted leaflet motion was relieved and mitral regurgitation was reduced to 1+ without the complication of mitral stenosis.

Although rare, dilated cardiomyopathy can affect the newborn infant. We describe a case of neonatal dilated cardiomyopathy successfully treated with partial left ventriculectomy with an excellent intermediate outcome. This case both validates the principles of partial left ventriculectomy and suggests that it can be successfully applied to the neonate.

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